C L A I M S

1. An expandable bladder for tyre-vulcanising apparatuses, having a toroidal conformation, comprising:
- at least one first layer (8) of a first elastomer material and one second layer (9) of a second elastomer material different from said first elastomer material;
- wherein said second layer (9) is at a position radially external to said first layer (8);
- wherein said first and second layers (8, 9) have an undulated interface profile (10);
- wherein said interface profile (10) defines mechanical-engagement elements (10a) between the first and second elastomer materials.

2. A bladder as claimed in claim 1, having at least one circumferential edge carrying anchoring tailpieces (1a).

3. A bladder as claimed in claim 1, wherein the interface profile (10) has a wave height (H) and a wave pitch (P), in which the wave height (H) is higher than or as high as one tenth of the wave pitch (P).

4. A bladder as claimed in claim 3, wherein the wave height (H) is higher than half the wave pitch (P).

5. A bladder as claimed in claim 1, wherein said mechanical-engagement elements (10a) have portions (10b) of mutual undercut constraint.

6. A bladder as claimed in claim 1, wherein at a position radially internal to said first layer (8), a third layer (11) of elastomer material cross-linked

with at least said first elastomer material is disposed.

7. A bladder as claimed in claim 1, wherein at a position radially external to said second layer (9), a fourth layer (12) of elastomer material cross-linked with at least one of said first and second elastomer materials is disposed.

8. A bladder as claimed in claim 1, wherein said first elastomer material comprises a polymeric butyl base and said second elastomer material comprises a polymeric silicone base.

9. A method of manufacturing an expandable bladder for tyre-vulcanising apparatuses, comprising the steps of:
- preparing at least one first elongated element (13) including a first raw elastomer material and at least one second elongated element (14) including a second raw elastomer material having a different composition from that of the first elastomer material;
- laying said first elongated element (13) on said toroidal support (18) in the form of coils wound around a geometric axis (X) of said toroidal support (18) so as to form a first layer (8) of said first elastomer material;
- laying said second elongated element (14) on a toroidal support (18) in the form of coils wound around the geometric axis (X) of said toroidal support (18) so as to form a second layer (9) of said second elastomer material at a radially external position to said first layer (8);
- said first and second layers (8, 9) having an undulated interface profile (10) wherein said interface profile (10) defines mechanical-engagement elements

(10a) between the first and second elastomer materials;
- vulcanising said bladder.

10. A method as claimed in claim 9, wherein said interface profile (10) has a wave height (H) and a wave pitch (P) in which the wave height (H) is at least as high as one tenth of the wave pitch (P).

11. A method as claimed in claim 10, wherein the wave height (H) is higher than half the wave pitch (P).

12. A method as claimed in claim 9, wherein said mechanical-engagement elements (10) have portions (10b) of mutual undercut constraint.

13. A method as claimed in claim 9, wherein at least one of said first and second elongated elements (8, 9) has a flattened cross-section conformation.

14. A method as claimed in claim 9, wherein at least one of said first and second elongated elements (8, 9) has a substantially triangular cross-section conformation.

15. A method as claimed in claim 9, wherein at least one of said first and second elongated elements (8, 9) has a substantially trapezoidal cross-section conformation.

16. A method as claimed in claim 9, further comprising a step of mutually coupling the first and second elongated elements (8, 9) in the longitudinal extension of same for preparing a continuous strip-like element (20) that is wound around the geometric axis (X) of said toroidal support (18) during the laying step.

17. A method as claimed in claim 16, wherein the coupling step is carried out before the laying steps.

18. A method as claimed in claim 16, wherein preparation of the continuous strip-like element (20) comprises the steps of:
- delivering the first elongated element (13) through a first delivery member (15);
- delivering the second elongated element (14) through a second delivery member (16) simultaneously with delivery of the first elongated element (13);
- guiding the first and second elongated elements (8, 9) in converging direction with respect to each other, towards a point of mutual coupling.

19. A method as claimed in claim 18, wherein delivery of the first and second elongated elements (8, 9) takes place by extrusion through a first and a second extruders (15, 16) respectively, which are part of said first and second delivery members.

20. A method as claimed in claim 16, wherein the continuous strip-like element (20) is made by co-extrusion of the first and second elongated elements (13, 14) through the same extruder (26).

21. A method as claimed in claim 16, wherein the coupling step is carried out simultaneously with winding of the strip-like element (20) on the toroidal support (18), at a point of mutual coupling between the elongated elements (8, 9), located on the toroidal support (18).

22. A method as claimed in claim 16, wherein the

coupling step is carried out simultaneously with winding of the strip-like element (20) on the toroidal support (18), at a point of mutual coupling between the elongated elements (8, 9), located upstream of the toroidal support (18).

23. A method as claimed in claim 9, wherein the first and second elongated elements (13, 14) are simultaneously laid on the toroidal support (18) at points (A, B) mutually spaced apart in a circumferential direction.

24. A method as claimed in claim 16, wherein following the coupling step, each of said elongated elements (8, 9) has a base portion (21, 22) integral with a base portion of the other elongated element, and at least one of said elongated elements (8, 9) has an apex (23, 24) transversely projecting from the base portion (21, 22) with respect to a mutual-alignment direction (D) of the base portions (21, 22).

25. A method as claimed in claim 24, wherein the first and second elongated elements (8, 9) are coupled at mutually offset positions transversely of a direction (D) of mutual alignment of the base portions (21, 22), so that each elongated element (13, 14) has said apex (23, 24) projecting in the opposite direction with respect to the apex of the other elongated element.

26. A method as claimed in claim 24 or 25, wherein the apex (23, 24) of an elongated element (8, 9) is turned up against a base portion (21, 22) of the other elongated element.

27. A method as claimed in claim 9, wherein laying of

each of said first and second elongated elements (8, 9) comprises the steps of:

- delivering the elongated element (8, 9) from a delivery member (15, 16, 17) disposed close to the toroidal support (18) to apply said elongated element onto the support itself;

- giving the toroidal support (18) a rotatory motion for circumferential distribution around the geometric rotation axis (X), so that the elongated element is circumferentially distributed on the toroidal support (18);

- carrying out controlled relative transverse-distribution displacements between the toroidal support (18) and the delivery member (15, 16, 17) to form said coils.

28. A method as claimed in claim 9, further comprising the step of applying at least one third layer (11), radially internal to said first layer (8), onto the toroidal support (18), which third layer (11) is of an elastomer material cross-linkable with said first elastomer layer.

29. A method as claimed in claim 9, further comprising the step of applying a fourth layer (12) at a radially external position to said second layer (9), said fourth layer (12) being of an elastomer material cross-linkable with at least said second elastomer material.

30. A method as claimed in claim 9, wherein said first elastomer material comprises a polymeric butyl base and said second elastomer material comprises a polymeric silicone base.

31. A method as claimed in claim 9, wherein during the

bladder-vulcanising step (1) at least one step of injecting elastomer material in said mould is carried out, to form at least one additional coating layer on the bladder (1).

32. A process for manufacturing tyres comprising the steps of:
- building a green tyre (6);
- inserting said green tyre (6) into a mould (3);
- supplying heat to said green tyre (6) to obtain cross-linking of the elastomer material of which it is made;
- moulding said green tyre (6) against the walls of said mould (3) through expansion of an expandable bladder (1) placed within said tyre (6) when the latter is enclosed in said mould (3);
- extracting the moulded and vulcanised tyre (6) from said mould (3);
wherein said expandable bladder (1) has a toroidal conformation and comprises:
- at least one first layer (8) of a first elastomer material and one second layer (9) of a second elastomer material different from said first elastomer material;
- wherein said second layer (9) is at a position radially external to said first layer (8);
- wherein said first and second layers (8, 9) have an undulated interface profile (10);
- wherein said interface profile (10) defines mechanical-engagement elements (10a) between the first and second elastomer materials.

33. A process for manufacturing tyres as claimed in claim 32, wherein said expandable bladder (1) is defined as claimed in anyone of claims 2 to 8.

34. A vulcanisation apparatus for tyres of vehicle wheels, comprising:
- a mould (3) having a plurality of cheeks (4) and sectors (5) adapted to define, by moulding, a tread pattern on the tread band of the tyre (6) and a plurality of graphic marks on the sidewalls of the same tyre (6);
- devices to supply heat to the green tyre (6) to be vulcanised to enable cross-linking of the latter, said devices being operatively associated with said mould (3);
- an expandable bladder (1) operatively associated with said mould (3) to exert pressure from the inside to the outside on said green tyre (6), bringing it into contact with said cheeks (4) and sectors (5) of said mould (3) during the moulding step;
wherein the expandable bladder (1) has a toroidal conformation and comprises:
- at least one first layer (8) of a first elastomer material and one second layer (9) of a second elastomer material different from said first elastomer material;
- wherein said second layer (9) is at a position radially external to said first layer (8);
- wherein said first and second layers (8, 9) have an undulated interface profile (10);
- wherein said interface profile (10) defines mechanical-engagement elements (10a) between the first and second elastomer materials.

35. A vulcanisation apparatus for tyres of vehicle wheels as claimed in claim 34, wherein said expandable bladder (1) is defined as claimed in anyone of claims 2 to 8.